APPARATUS AND METHOD FOR FILLING LIQUID CONTAINERS

Cross Reference to Related Application

This application is based on Provisional Application Ser. No. 60/421,509 filed October 28, 2002.

Background of the Invention

1. Field of the Invention

The present invention pertains to apparatus and methods for filling containers with liquid. More specifically, the present invention pertains to container filling apparatus and methods of the use thereof which are provided with a vertically disposed tubular filling lance operatively connected to a source of liquid and to a power device by which the lance may be moved between raised positions above the containers and lowered positions, when coaxially lined with a filling hole of the container, so as to extend through the filing hole and into the container for filling with liquid.

2. Description of the Prior Art

There are many designs for filling containers with liquid. Some of the most successful and efficient designs are those of the type having a tubular filling lance which is operatively connected to a source of liquid and which is vertically moveable by a power device between raised and lowered positions. The lance is positioned above an opening in the container and lowered into the container for filling thereof. After the container is filled, the lance is returned to a fully raised and/or withdrawn position. For ease and efficiency of handling, two or more, frequently four, empty containers are placed on wooden pallets and moved along a conveyor to a filling station at which the

filling lance is located. The filling hole closures are removed in some fashion prior to reaching the filling station. Unless the openings are oriented in some fashion prior to reaching the filling station, they will be at random locations. Even if the openings are oriented in a preselected fashion, some mechanism must be provided for moving the vertical filling lance to a coaxially aligned position with each of the fill openings so that the tubular lance may be lowered into the drum for the filing thereof. In most designs of the prior art, this requires manual direction and manipulation of the lance. Manual manipulation requires an operator and slows what might otherwise be considered an automatic operation. The present invention alleviates this problem.

Summary of the Present Invention

The present invention provides apparatus and methods for automatically filling containers (or drums), the upper ends of which are provided with fill openings (or bungholes) and in which two or more of the drums are supported on a pallet for moving along a conveyor to a filling station. Like most drum filling systems, the filling station is provided with a vertically disposed tubular filling lance which is operatively connected to a source of liquid and to a power device by which the lance may be moved between raised positions above the drums and lowered positions, when coaxially aligned with one of the drum fill openings (or bungholes), extending through the opening and into the drum for filling the drums with liquid.

The tubular filing lance of the present invention is uniquely carried on lance supporting apparatus by which the filling lance may be horizontally moved in two directions above the drums, along an X-axis perpendicular with movement of the conveyor and along a Y-axis perpendicular to the X-axis (parallel to movement of the

conveyor). Movement along the X and Y axes is facilitated by a gantry type arrangement in which lance carriage supporting members move (X-axis movement) along parallel rails of a gantry frame. Movement along the Y-axis is facilitated by a lance carriage on which the lance is supported and which is moveable along the gantry support members in directions perpendicular to the gantry rails (Y-axis movement).

A photoelectric sensing device is located at the filling station and above the drums for simultaneously sensing the location of each of the drum fill openings, regardless of their orientation. Controls are operatively connected to the photoelectric sensor and the lance supporting apparatus to selectively position the lance, by movement along the X and Y axes for coaxial alignment with each of the fill openings and for subsequently signaling the power device for lowering the lance through the fill openings in each of the drums for the filling thereof. After all of the drums on the pallet are filled, the pallet is transported by the conveyor system to a location where the openings are closed with a bung or closure member and the drums are moved to a location for further handling for storage or shipment.

The apparatus and method of the present invention results in automatic filling of two or more drums located on a pallet without having to orient each of the drum fill openings and without having to provide an operator to manually align the filling lance with each of the openings thereof. A number of other objects of the invention will be apparent from reading the description in conjunction with the accompanying drawings.

Brief Description of the Drawings

Fig. 1 is a perspective view of the automatic filling apparatus of the present invention, according to a preferred embodiment thereof.

Description of a Preferred Embodiment of the Invention

Referring to Fig. 1, there is shown apparatus A for automatically filling containers such as drums 1, 2, 3 and 4 with liquid. The drums 1, 2, 3 and 4 are placed on a pallet 5 and moved on a conveyor, a portion of which is represented at 6 in Fig. 1. The empty drums are placed on the pallet 5 at some supply location and moved by an elongated conveyor, of which the portion 6 forms a part, to a filling station as represented in Fig. 1. Below the conveyor portion 6 is a scale 7 which is capable of weighing the drums 1 – 4 and the pallet 5.

At the filling station is provided a vertically disposed tubular filling lance 10 which is operatively connected through a hose 11 or the like to a source of liquid (not shown). The lance 10 and valve and valve actuator assemblies 12 and 13, by which flow between the supply hose 11 and lance 10 is controlled, are attached to a lance carriage 14 which is mounted on a vertical mast 15 for vertical up and down movement thereon. A power device 46 is attached to the mast and is operatively connected to the lance carriage 14 for the up and down movement thereof. Since the lance 10 is supported by the mast carriage 14, the power device 46 is therefore effective in moving the lance 10 between raised positions above the drums 1, 2, 3 and 4 as shown in Fig. 1 and lowered positions, when coaxially aligned with one of the drum filing holes (two of which are shown at 2a and 4a), extending through the filing hole and into the container of the drum for filling the drums with liquid.

There are a number of designs for the construction of such vertically moveable filling lances. More details of such construction and the operation thereof in a particularly well accepted design may be seen in U.S. Patent No. 6,053,219.

The mast 15 is attached to and extends upwardly from a mast carriage 16 which is mounted on parallel rails 17 and 18 for movement which is generally parallel to movement of the conveyor 6. A power device 19 would be mounted at the end of the rail 17 and 18 for driving a shaft 20 which may in turn drive one or more gears and chains or other mechanisms (not shown) for moving the mast carriage 16 and the mast 15, the lance carriage 14 and the lance 10 in a direction parallel with movement of the conveyor 6 which we refer to in X, Y, Z coordinates as the Y-axis.

The rails 17, 18, mast carriage 16, mast 15, lance carriage 14 and the lance 10 are all supported above the drums 1, 2, 3 and 4 on a gantry frame made up of vertical supports 21, 22, 23 and 24 and horizontal supports 25, 26, 27 and 28. A pair of parallel rails 29 and 30 are carried by the gantry frame and the rails 17 and 18 rest thereon for transverse movement in a direction perpendicular to movement of the conveyor 6, a direction in X, Y, Z coordinates which we refer to as the X-axis. A power device 31 connected to a rotating shaft 32 drives gears, chains or other mechanisms (not shown) which are operatively connected to the rails 29 and 30 for the movement thereof along said X-axis.

Affixed to and vertically extending from one of the horizontal members 27 of the gantry frame, is a stationary vertical support 40 from which extends a horizontal arm 41 at the distal end of which is mounted an electronic or photoelectric sensing scanner 42 which, when the drums are located at the filling station such as in Fig. 1, is capable of scanning and recording in X, Y coordinates the location of the filling hole or bunghole in each one of the drums 1, 2, 3 and 4.

The actuator and valve assemblies 12, 13 and the power devices 19, 31 and 46 are all operatively connected to a controller 50 which includes a computer which is also operatively connected to the photoelectric scanner 42. The controller is also connected to scale 7.

In operation, a fork-lift (not shown) loads an empty conveyor with the pallet 5 and the four drums 1, 2, 3 and 4 thereon. The bungs or fill opening closures have been previously removed to leave the bunghole or fill opening opened. The pallet 5 advances to an unoccupied accumulation zone in route to the filling station of Fig. 1. Upon appropriate signal, the pallet 5 loaded with empty drums 1 – 4 advances to the position shown in Fig. 1. Upon arrival, a photo-eye (not shown) may be used to recognize the pallet and signal the control system to stop the conveyor.

At this point, the mast carriage 16, mast 15 and lance carriage 14 and lance 10 have all been moved toward the horizontal support 27 of the gantry frame so that all of these components are clear of the drums 1, 2, 3 and 4, leaving an unobstructed view of the ends thereof from the electronic scanner or photoelectric sensor 42 thereabove. The electronic scanner 42 scans the four drum cluster and identifies each bunghole or fill opening. It then reports the X and Y coordinates of each bunghole to the controller 50. The controller computer determines the shortest distance to the closest drum bunghole (bunghole 2a of drums 2 in Fig. 1) and the computer in cooperation with the control system activates power devices 19 and 31 so as to position the lance 10 directly above and in coaxial alignment with the bunghole 2a. The computer, in cooperation with the scale 7, computes the tare weight, set points and tracking information for the lance 10. A signal from controller 50 then activates the power device 46 to lower the lance carriage

14 causing the lance 10 to extend into the fill hole or bunghole 2a of the first drum 2. The lance 10 moves through its downward path (Z-axis) into the drum and then stops at a predetermined distance from the bottom.

Once the lance reaches the proper bottom position, the valve and the actuator assemblies 12 and 13 are operated to first allow liquid to flow through the hose 11 and lance 10 at a slow fill rate until reaching a predetermined level to prevent foaming of the liquid product. When the slow fill level is reached, both valves 12, 13 are fully opened for fast fill mode. This continues until a predetermined weight is achieved (approximately 90% full). Then the valves 12, 13 are again repositioned for a slow fill mode until the drum is filled. Flow is shut off and the lance 10 is raised (Z-axis) to its home position.

The computer then signals the power devices 19 and 31 of the gantry system to position the lance 10 to the X, Y coordinates of the next closest drum bunghole. Its arrival signals the computer to activate the control signal for repeating the cycle, lowering the lance 10, filling the second drum and removing the lance 10. The cycle is repeated for the third and fourth drum.

After the fourth drum is filled, the weight is calculated and recorded by the computer. The computer then signals the conveyor to start, allowing the fully loaded pallet 5 to move out of the filling station as another pallet of empty drums is conveyed thereto for filling.

After the drum openings are closed or rebunged, the pallet 5, loaded with full drums 1 – 4, is conveyed to the end of the system and to the next available accumulation zone (not shown) of an outfeed conveyor system. The forklift may remove each full load

from the end of the outfeed conveyor and a photo eye may be used to recognize when it is gone. This would then signal the controller 50 to start subsequent conveyor zones allowing all the loads to advance one position.

Thus, the unique apparatus and method of the present invention utilizes an electronic sensing device for simultaneously sensing the location of each bunghole or fill opening of a plurality of drums located on a pallet, regardless of their orientation. The locations are sent to a computer to which controls are operatively connected for moving lance supporting apparatus to selectively position the lance by movement along X and Y axes for coaxial alignment with each of the fill openings and for subsequently signaling the power device for lowering the lance (Z-axis) through the fill openings in each of the drums for the filling thereof.

The primary object and advantage of the apparatus and method of the present invention is the automatic filling of two or more drums located on a pallet without having to orient each of the drum fill openings and without having to provide an operator to align the fill openings thereof. However, other objects and advantages of the invention will be apparent. While a preferred embodiment of the invention has been described herein, those skilled in the art will be able to design many variations thereof without departing from the spirit of the invention. Accordingly, it is intended that the scope of the invention be limited only by the claims which follow.